

A landscape photograph of a fjord. The background features steep, green mountains with some snow patches. The foreground is dominated by a large colony of birds, likely terns, on the water's surface. A small boat with people is visible in the middle ground.

INTEGRATED ECOSYSTEM RESEARCH
From Physics to Fish

INTEGRATED ECOSYSTEM RESEARCH

In the 2005 *Science Plan*, the National Research Council strongly urged the Board to develop integrated research programs for each of the large marine ecosystems off Alaska, with initial focus on the Bering Sea and Aleutian Islands. Our first program, the Bering Sea Integrated Ecosystem Research Program, was launched in 2007 as a six-year, \$52 million partnership with the National Science Foundation to improve our understanding of how the Bering Sea may respond to climate change, particularly as mediated through changes in seasonal ice cover.

In September 2008, the Board released a request for proposals for a second integrated ecosystem research effort focused on the Gulf of Alaska. It will look at how environmental and anthropogenic processes, including climate change, may affect animals and plants at various trophic levels and dynamic linkages among trophic levels, with particular emphasis on fish and fisheries, marine mammals, and seabirds within the Gulf of Alaska.



Bering Sea Integrated Ecosystem Research Program

ALASKA'S BERING SEA FISHERIES PROVIDE NEARLY HALF OF THE SEAFOOD CONSUMED IN THE U.S., FORMING A POWERFUL ECONOMIC ENGINE FOR FISHING COMMUNITIES AND THE CORE OF AN OCEAN-BASED SUBSISTENCE LIFESTYLE. WHALES, SEALS AND SEABIRDS TRAVEL FROM AFAR TO FEED AND MATE HERE. FUR SEALS BREED ON ISLAND ROOKERIES, WHILE WALRUS HAUL OUT ON SEA ICE TO BEAR YOUNG.

Climate change and reduced ice cover could significantly impact the Bering Sea ecosystem. This program seeks to understand the mechanisms that create and sustain this highly productive ecosystem, and how they might be altered over time.

Initiation

Planning for the Bering Sea Integrated Ecosystem Research Program (BSIERP) began in spring 2005. The Board's draft Science Plan had been reviewed by the National Research Council and was in production. In its 2005 RFP, the Board attempted to attract a proposal for a workshop to develop an implementation plan for the BSIERP, but there were no submissions. In March 2005, the Board approved the staff moving forward with establishing a planning team and coordinating with an interagency group. The Alaska Fisheries Science Center reported on its efforts to put together a study of climate change and loss of sea ice in the Bering Sea and how they might impact fish stocks and fisheries.

The Board heard back from the planning group in September 2005. The group identified the central scientific issue: How the Bering Sea and its living marine resources

may be impacted by potential changes in climate, mediated to great extent by the anticipated reduction in or overall loss of seasonal sea ice cover over the next 30 years. They recommended that in the absence of a fully-developed implementation plan, the 2006 RFP focus on retrospective, process, and modeling studies on six key research questions focused on components of the Bering Sea ecosystem and how they might respond to climate change. They also noted the potential for collaboration with the National Science Foundation and its recent call for proposals for the Bering Ecosystem Study (BEST), which referenced NPRB in the announcement.

After reviewing this report and recommendations from the Science Panel, the Board placed a \$1.2 million research priority in the 2006 RFP for one- to two-year retrospective and modeling studies to examine climate change impacts on the Bering Sea ecosystem. The Board also approved funding for planning teams for each of the two core regions, the Bering Sea and Gulf of Alaska, to develop the details of five-year implementation plans for input into the 2007 RFP. It also approved funding for a Bering Sea ecosystem modeling committee that would develop standards for statistical robustness of the models and validation of model results.





John Pratt

Sand lance are an important forage fish in the Bering Sea.

Implementation Plans

In March 2006, the Board received a draft implementation plan and discussion document for the Bering Sea study, along with a plan for the Loss of Sea Ice (LOSI) program at the Alaska Fisheries Science Center. A draft discussion paper on Gulf of Alaska ecosystem planning was also presented. The Board decided to move ahead with further planning for the Bering Sea study, but to delay the Gulf study by at least one year. It approved establishing a scientific steering committee to further develop the Bering Sea study, refine the main research themes, and draft a call for pre-proposals for review in September. They provisionally adopted a five- to six-year schedule for the potential study that would include one year of planning and synthesis, three years of field work, and one to two years of integration and reporting.

In September 2006, the Board reviewed the draft BSIERP implementation plan and draft call for pre-proposals for the study that would run from 2007–2013 (later adjusted to end in late 2012). It also heard the first report of the Ecosystem Modeling Committee and of an opportunity to partner with the National Science Foundation (NSF). William Wiseman, Program Manager for Arctic Natural Science at NSF, was present to answer questions and offer clarifications as necessary. The Science Panel had raised a number of issues when it initially considered the idea of a partnership with NSF at the panel's meeting in late August. Between the panel meeting and the Board meeting, the staff worked



Ryan Kingsberry

Kittiwakes along the cliffs of St. George Island.

with NSF to provide answers to these issues, which the Board then reviewed. These included concerns over differing policies on data ownership, whether applied science could be supported, fiscal risk for each agency, collaboration of scientists funded by different agencies, processes for making course corrections, and how to split up the research efforts and questions between NSF and NPRB.

The Board concluded that the issues were being addressed satisfactorily, and unanimously endorsed establishing the partnership with NSF. It then instructed staff to work with NSF in resolving all remaining issues and draft a letter of agreement for the Board to review on October 18, 2006. The Board recognized that this was a unique opportunity and that the goal should be to get as close as possible to having one team, working seamlessly and guided by tight protocols, under the twin banners of NPRB and NSF. The Board also approved release of the BSIERP call for pre-proposals at a funding level of \$14 million once they completed a teleconference on October 18, 2006 to review the NSF partnership concerns. The RFP was released on October 23, 2006. The Science Panel met in November to review the three pre-proposals, one having three variants. The Board then met on December 5, 2006 to review the proposals and the Science Panel recommendations and called for full proposals from two main groups: the NOAA Alaska Fisheries Science Center—University of Alaska Fairbanks group, and one from the University of British Columbia.

Climate change and reduced ice cover could significantly impact the Bering Sea ecosystem.

This historic partnership seeks to understand the mechanisms that create and sustain this highly productive ecosystem, and how they may be altered over time as the climate changes.

BSIERP Becomes Reality

Two full proposals to the BSIERP RFP were received by March 15, 2007. The two proposals underwent anonymous technical reviews, and were then subsequently reviewed by a joint NSF-NPRB science panel the week of June 11th in Washington, D.C. The Board and William Wiseman of NSF met on June 26-27, 2007, received the joint science panel recommendations and proceeded to fashion the BSIERP, based mainly on the full proposal received from the NOAA-UAF group. They capped the study at \$14 million, but approved specific components adding up to only \$13.2 million. The remaining funds would be made available to fill in identified gaps or to help support the marine mammal patch dynamics study from UBC.

The study was further fleshed out at meetings in September and December 2007, when the Board approved additional funds for comparative patch dynamics studies involving northern fur seals around the Pribilofs and Bogoslof Island, and one study focusing on benthic feeding walrus at St. Lawrence Island. The Board also approved other components involving local and traditional knowledge, epibenthos, and microzooplankton studies and ecosystem modeling. As a result of these funding decisions, the Board had approved a total of \$15,992,043 for the BSIERP. NSF had contributed about \$21 million and NOAA and other Federal agencies about \$14.9 million, bringing the partnership total to nearly \$52 million.

NPRB also organized and supported the first meeting of the principal investigators for the joint BEST-BSIERP program in Seattle on September 17-19, 2007, where nearly 100 scientists and program management staff reviewed the scope and details of the program, worked toward achieving full program integration, and discussed how to coordinate the field studies and cruise planning for this ambitious effort. They also worked on program management issues and a management plan. A full-time program manager for the combined BEST-BSIERP project, Tom Van Pelt, was hired in June 2008. Nora Deans, as principal investigator for the Education and Outreach component, produced a detailed communication and outreach plan focused on sharing news from the field component among a variety of audiences, including coastal communities and national media. Carolyn Rosner created a dynamic website with constantly changing news for both the scientific

community and the public. For details, visit the project website at www.bsierp.nprb.org.

First Field Year: 2008

The first field year for the BSIERP commenced in March 2008 with a cruise of the United States Coast Guard icebreaker *Healy* from Dutch Harbor to St. Lawrence and back to study ice conditions, the benthic prey fields and walrus distribution. Other field activities took place in 2008, including more *Healy* and NOAA cruises and patch dynamics studies on the Pribilofs with exploratory work on Bogoslof Island, along with further model development and interactions with the Ecosystem Modeling Committee. Status reports were presented to the Board at its April and September 2008 meetings. At the September meeting, the Board approved an additional \$120,000 for the Ecosystem Modeling Committee (EMC) to apportion to retrospective or modeling studies at its discretion. It also approved the idea of a BEST-BSIERP advisory group that would function as a big picture program evaluation group and as a go-between for the different panels and the Board. It would include two advisory panel members, three science panel members, and the chair of the EMC. The Board also received a presentation on education and outreach activities surrounding the BEST-BSIERP program, which include a dynamic website, media and outreach campaign, public radio programming, potential for an exhibition at the Smithsonian's Ocean Hall, and community outreach. In mid-October, BSIERP-BEST principal investigators met in Girdwood, Alaska, for the second annual principal investigator meeting, focusing on summaries of the 2008 field seasons, planning for 2009 field and modeling work, and identification of "headline" results and key points for further integration work across project components.



Icebreaker *Healy* cruise March 2008.

FEATURE PROJECT

Bering Sea Program Highlights

Nearly 100 federal, state, university and private institution scientists are studying a range of issues in the Bering Sea, from atmospheric forcing and physical oceanography to humans and communities, including the attendant economic and social impacts of a changing ecosystem. Both organizations are supporting ecosystem modeling and data management.

Studies supported by the National Science Foundation include:

- Climate, oceanography, and lower trophic level—benthos, primary production near sea ice, nutrients, modeling, micro- and meso-zooplankton, euphausiids, biophysical moorings, and physical oceanography
- Social science research—relationships between a changing marine environment and Bering Sea communities

Studies supported by the North Pacific Research Board include:

- Climate, oceanography, and lower trophic levels—benthos, micro-zooplankton, biophysical moorings, and physical oceanography
- Forage species—euphausiids, myctophids and capelin
- Fish—arrowtooth flounder, Pacific cod, and walleye pollock
- Marine mammals—fur seals, walrus and broad-scale whale distribution
- Seabirds—thick-billed murres, black-legged kittiwakes, and broad-scale seabird distribution
- Local and Traditional Knowledge (LTK—subsistence harvest and LTK ecosystem perspectives
- Education, outreach, and communication



For more details and to follow along with the field science, local and traditional knowledge research, ecosystem modeling and communication, education and outreach as it unfolds, visit the dynamic project website (www.bsierp.nprb.org) and download the richly illustrated Bering Sea program brochure.



Gulf of Alaska Integrated Ecosystem Research Program

THE GULF OF ALASKA IS DOMINATED BY THE STRONGEST AND MOST PERSISTENT CURRENTS FOUND ALONG EITHER COASTS OF NORTH AMERICA. THESE CONDITIONS REFLECT THE INFLUENCE OF WEATHER AND CLIMATE AND PROVIDE THE LINK TO EFFICIENTLY TRANSFER PHYSICAL AND BIOLOGICAL "SIGNALS" FROM LOWER LATITUDES OF THE NORTH PACIFIC OCEAN INTO THE NORTHERN GULF OF ALASKA. ALTHOUGH LARGE GAPS REMAIN IN OUR UNDERSTANDING OF THIS COMPLEX MARINE ECOSYSTEM, OCEAN RESEARCH IN THE GULF HAS BEEN ONGOING FOR DECADES. ANY NEW PROGRAM NEEDS TO CAPITALIZE ON THE EXISTING KNOWLEDGE AND DATA.

Program Development

The Board first started considering an integrated research program in the Gulf of Alaska in September 2005, along with the Bering Sea Project and completion of the *Science Plan*, which emphasized the need for ecosystem research. At that meeting, the Board approved funding to support a planning team to start developing the program. A discussion paper was presented in March 2006 by Dr. Carl Schoch, working under contract to the Board, but the Board decided to delay further development of the Gulf of Alaska Integrated Ecosystem Research Program (GOAIERP) until it had more experience with the BSIERP. Further discussion occurred in September 2006 and April 2007. At the April meeting, the Board discussed development of the Gulf program and heard a report from the executive director of the EVOSTC about a potential collaboration with NPRB. Although the original intent in crafting the Gulf of Alaska project was to release a call for pre-proposals in October 2007, the Board concluded that it would be better to wait until February or March 2008, but not wait as long as October 2008. This would give time for it to learn from the ongoing Bering Sea Project. The Board also expressed interest in the collaboration with the EVOSTC.

In June 2007, while finalizing the BSIERP components, the Board noted that the requirement for large multidisciplinary teams to send in proposals and have a winner-take-all approach led to less competition than the Board desired. They said this should not happen again for the Gulf of Alaska program. The process of developing proposals needed to be fully competitive and well thought out. The Board emphasized that it would thoroughly consider the lessons learned from the BSIERP when proceeding with the development of the GOAIERP.

The Science Panel, meeting in August 2007, reflected upon the approaches and lessons learned in the BSIERP. Everyone agreed not to repeat the large group, winner-take-all approach, nor to follow the NSF individual proposal approach. Instead, they recommended that a directed, but still competitive strategy should be explored. Staff suggested a modular approach, where all modules that would make up an integrated ecosystem research program are identified initially and roughly defined by NPRB (as was done for LTK and patch dynamics components of BSIERP).



Modules would be process-oriented and could be competed openly, followed by focal meetings like those for the patch dynamics and LTK components, which proved to be extremely valuable and productive. Such an approach would give control, ensure competition, allow for creativity within defined modules and prevent any group or institution from dominating. Such a modular approach could also deal with the issue of insufficient funding, depending upon available partnerships, as well as ensure a high quality, comprehensive and integrated program comparative to BSIERP. Core modules could be identified for funding simultaneously in a first instance, with additional modules designed ahead of time to be added as more funding becomes available. The Science Panel endorsed this idea and added that relevant long-term datasets should be identified and their availability determined to ensure a level playing-field in terms of data access for all applicants.

In September 2007, the Board agreed with the recommendations of the Science Panel and said it wanted to evaluate the BSIERP process and determine whether it was suitable for the Gulf of Alaska program. They requested that staff further develop the modular approach for the April 2008 meeting.

By April 2008, staff had fleshed out the beginnings of a modular approach, and the Board's science director, Francis Wiese, presented a detailed overview with the following specifics:

1. Process-oriented multi-disciplinary modules will be competed individually.
2. Give longer timeline than BSIERP for module teams to develop proposals as no field work is planned for 2009.
3. 2009 would be used for programmatic and logistic development, as well as to start retrospective analysis and modeling (depending on modular approach chosen).
4. Field seasons in 2010–2012 will give a one year field overlap with BSIERP and thus a potential to determine downstream effects (depending on modular approach chosen, see presentation).

The Board thoroughly discussed the suggestions and through unanimous vote, requested that staff develop five examples for their review in September 2008, along with a discussion of strengths and weaknesses of each. Staff also should be prepared to release a call for pre-proposals. The Board was also informed that the *Exxon Valdez* Oil Spill Trustee Council had not agreed to pursue a partnership with the Board for a joint GOAIERP.

Preliminary Program

In September 2008, the Board finally approved the release of a call for pre-proposals that would address the overarching question of how environmental and anthropogenic processes, including climate change, affect various trophic levels and trophic linkages in the Gulf, with particular emphasis on fish and fisheries, marine mammals, and seabirds. The goal would be to determine and quantify the processes driving upper trophic level populations and to better understand observed and potential future variability therein as they affect key management issues in the North Pacific.

The overall Gulf of Alaska Integrated Ecosystem Research Program would range from climate and physics up through fish, birds, mammals and humans. It would have four components: upper trophic level species, forage base, lower trophic level and physical oceanography, and ecosystem modeling. They would be competed separately and integrated in a post-proposal selection process.

The program is anticipated to run from 2009 to 2013 or 2014, and cost about \$9 million including \$1 million reserved for unanticipated expenses, including ship time. It would need at least one fish species of commercial importance and encourage two areas for comparative study, though not require it. It would need to identify clear management application. There would be an option of two or three field seasons but none could exceed \$3 million. It would envision a planning year and a wrap-up year, each funded at about \$500,000.

The call for pre-proposals focused on just the upper trophic level to investigate the processes and mechanisms that regulate the productivity and population trends, including their variability, of the top level species of interest. The call for pre-proposals was released on September 26, 2008. Further development for the Gulf of Alaska integrated program will be covered in the next annual report.

